

CSE105 Closed Book Quiz, Thursday, Nov. 11, 1999

1. Construct a CFG for the language

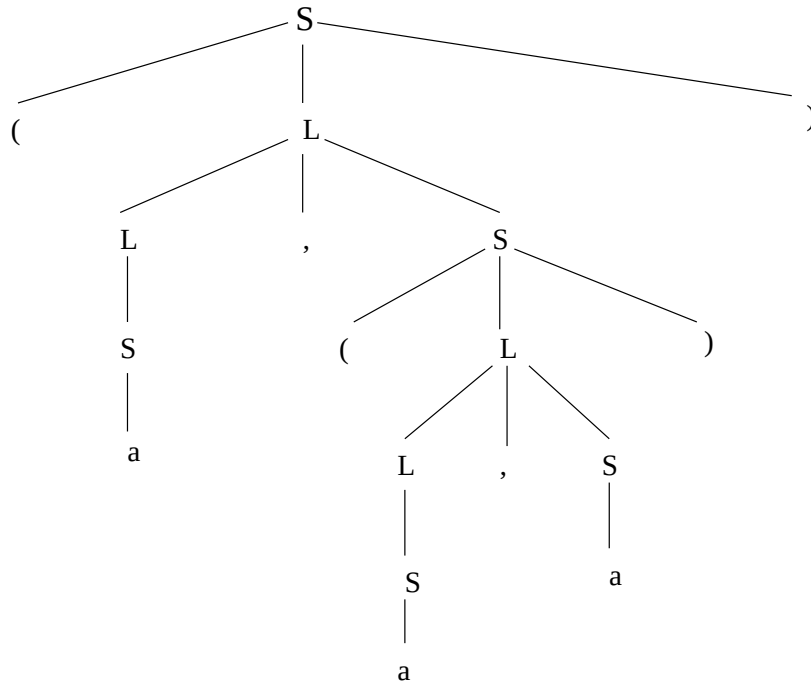
$$\{a^n b^{2n} \mid n \geq 1\}$$

$$S \rightarrow aSbb \mid abb$$

2. Draw a parse tree for the string **(a,(a,a))** using the CFG below. (Here, the nonterminals of the grammar are $\{ () , a \}$, and the start variable is S)

$$S \rightarrow (L) \mid a$$

$$L \rightarrow L, S \mid S$$

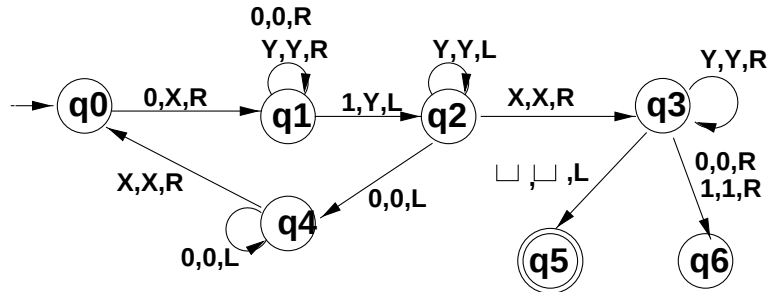


3. Given the Turing machine below for $\{0^n 1^n \mid n \geq 1\}$, show the configurations of the Turing machine on input 0010, beginning with the start configuration.

$Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6\}$

$\Sigma = \{0,1\} \quad \Gamma = \{0,1, X, Y, \sqcup\}$

q_0 start q_5 accept q_6 reject



$q_0 0010 \sqcup$
 $X q_1 010 \sqcup$
 $X 0 q_1 10 \sqcup$
 $X q_2 0 Y 0 \sqcup$
 $q_4 X 0 Y 0 \sqcup$
 $X q_0 0 Y 0 \sqcup$
 $X X q_1 Y 0 \sqcup$
 $X X Y q_1 0 \sqcup$
 $X X Y 0 q_1 \sqcup$

REJECT

4. Fill in the blanks: A grammar is ambiguous if

it can generate more than one distinct parse tree for the same string.